3.0 PHYSICAL SETTING

3.1 Climate

Precipitation averages just over 10 inches annually at MCAS Miramar, generally associated with low intensity storms in the winter and spring. Frosts are light and infrequent, with the growing season ranging from 345 to 360 days. Winds are usually gentle and come from the west, especially during summer afternoons. The average annual temperature is about 63 degrees Fahrenheit. The average daily high is 71 degrees, and the low averages 53 degrees. Weather patterns are dominated by a subtropical ridge with a shallow marine layer and pronounced low-level inversion, and the moderating effects of the California current off-shore. This Mediterranean climate creates a semi-arid condition, with warm, dry summers and mild winters. Weather data are available from the Marine Corps Meteorology and Oceanographic Command Detachment on MCAS Miramar, and from the National Weather Service at Lindbergh Field, the commercial San Diego Airport.

Four climatic aspects affect erosion on the Station (Kellogg and Kellogg 1991):

temperature mildness (*i.e.*, warm summers, cool winters), which results in comparatively immature Station soils with a low tolerance to erosive forces;
Mediterranean semi-aridity (*i.e.*, Mediterranean precipitation pattern fosters high erosion rates because ground protection is least when precipitation peaks) (Kirkby 1980));
winter storm progression (*i.e.*, the amount of soil moisture before an intense storm); such storms create significant sheet and rill erosion unless the ground is dry enough to absorb water quickly); and
"fire weather" *(i.e.*, extremely dry, warm fall winds), which results in wildfires that create conditions conducive to extremely high soil loss during storms. Firebreaks[1] used to control wildfire damage are secondary erosion agents.

Hazardous fire conditions occur during the fall when there are very dry, warm winds and vegetation is dry. High erosion rates can result when intense storms follow a fire. Fire is a natural component of the southern California landscape, thus, the vegetation at MCAS Miramar is adapted to occasional fires. However, the risk of large-scale, disastrous fire has increased with urbanization and past fire suppression policies.

3.2 Geology and Soils

Steep, eroded, gravelly, or cobbly terraces, consisting of the Poway group of non-marine sandstone and coarse cobbly "Stadium" conglomerate, dominate upland areas of East Miramar. The conglomerate is overlain by softer, more erodible tongues of marine, lagoonal, and non-marine sandstone called the Mission Valley Formation, which is then overlain by Pomerado conglomerate (Figure 3.2a) (Kennedy 1975). This area is highly dissected, with rugged divides, dendritic drainages, and V-shaped valleys (Figure 3.2b).

In some parts of MCAS Miramar the loss of plant cover has resulted in severe erosion, causing a loss of topsoil and potential streambed siltation. Landslides are common along valley walls in clay-rich portions of Mission Valley and Friars formations. West Miramar encompasses gravelly marine terraces (mesas) of the Lindavista formation with areas of terrace escarpment and alluvium. It was formed under fluctuating estuarine and beach conditions with subsequent uplift (Kennedy 1975).

More than three-quarters of MCAS Miramar soils are in the Redding group of shallow, cobbly, or gravelly loams that range from 2 to 50 percent slopes. Permeability is very slow due to a hardpan, and fertility is low. Erodibility of the Redding series is considered severe because of shallow depth to rock and, in some cases,

[1] MCAS Miramar has converted its former firebreaks to fuelbreaks, which are less prone to significant erosion.

steepness. Where these soils are more gently sloping, they form a hummocks topography known as "mima mounds," which harbor vernal pool habitat and associated Special Status Species.

In extreme western portions of MCAS Miramar are three soil types with small acreages but characteristics appropriate for raising irrigated crops…Chesterton fine sandy loam, Carlsbad gravelly loamy sand, and Altamont clay (Figure 3.2a).

3.2.1 Erosion Hazard Ratings

Almost all MCAS Miramar's soils are severely erodible, according to the Natural Resources Conservation Service, because of either steepness, shallow depth to rock, shallow depth to a hardpan, or excessive silt in surface texture composition. Exceptions are 60-70 acres of clay-textured types. Also, in many areas numerous soil cobbles reduce erodibility by self-sealing gullies or channels.

3.2.2 Topography

Elevations on MCAS Miramar range from just over 1,178 feet above mean sea level in the east to 240 feet in the west (Figure 3.2b). Gently sloping, eroded plateaus or mesas where flight line and air operations are located are cut by southwesterly draining canyons. These give rise to a series of marine wave-cut terraces, which, in turn, grade to the steep and dissected hills of Sycamore Canyon. The hummocky topography that includes an impervious subsurface layer supports vernal pool habitat in western and central areas of MCAS Miramar. It consists of alternating well-drained to moderately well drained mounds and poorly drained swales.

3.3 Hydrology and Watersheds

3.3.1 Watersheds

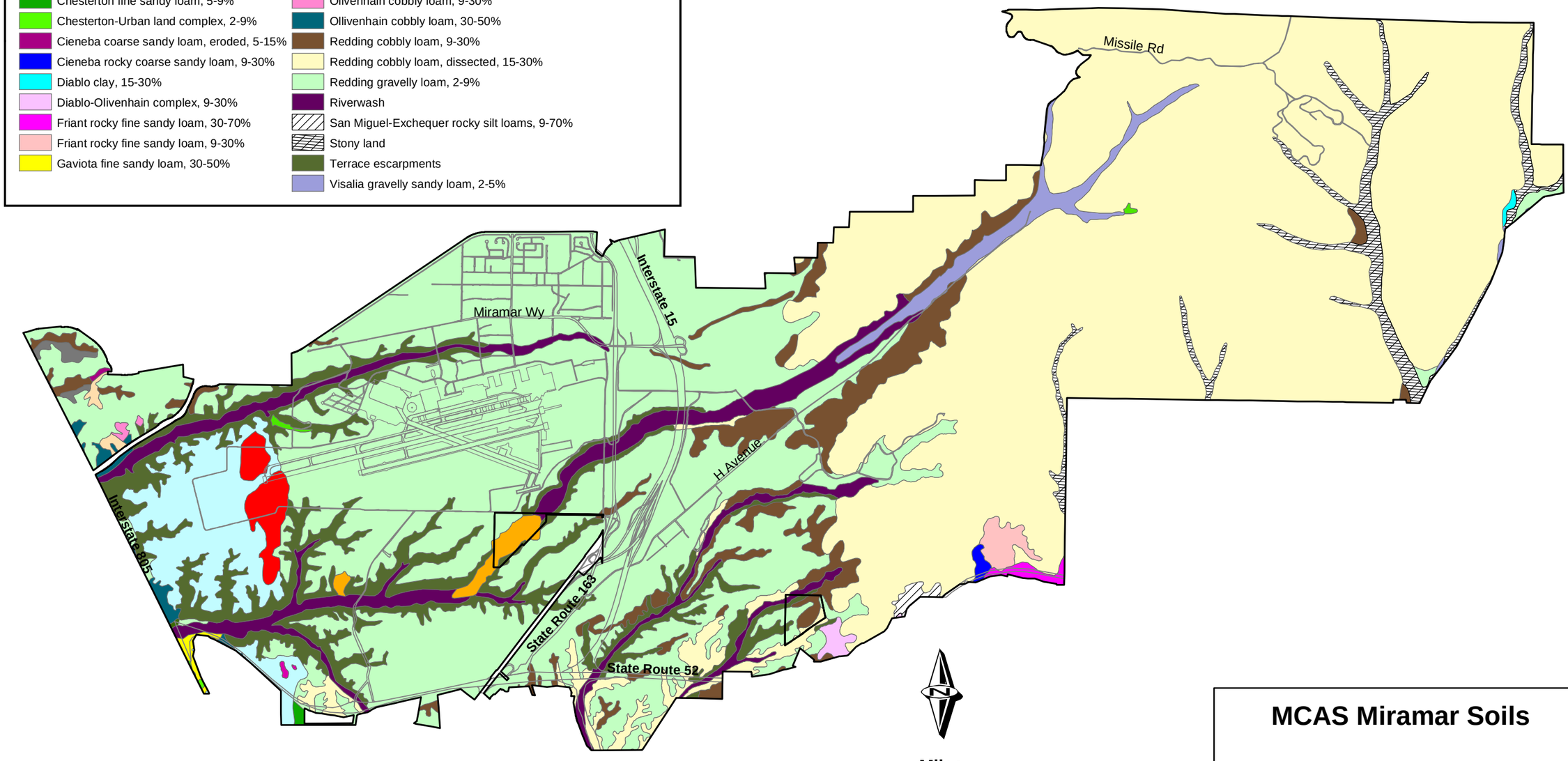
Local watersheds drain to the south or southwest (Figure 3.2b). Murphy, Elanus, Oak, Spring, Quail, Little Sycamore, West Sycamore, and Sycamore canyons drain into the San Diego River and then to the coast. San Clemente Canyon enters Rose Canyon and then Mission Bay. Carroll and Beeler canyons eventually drain into Soledad Valley and then proceed to the coast. Many of these watersheds wholly or partly originate on MCAS Miramar, the main exceptions being Sycamore and Beeler canyons. Most sub-basins are small, which contributes to a high sedimentation rate as particles have less opportunity for deposition before becoming part of a stream system.

3.3.2 Floodplains and Impoundments

One-hundred-year return period floodplains have been completely mapped at a planning level scale for MCAS Miramar (Smith and Lichvar 2001). Areas of potential flooding are narrow because of canyon topography, but these narrow canyons have significant high-water flooding potential. A single gauging station exists on San Clemente Canyon Creek just east of I-15. Peak flows (2-year, 24-hour) for Rose Canyon have been calculated at between 165 and 268 cubic feet per second (Woodward-Clyde 1986), and more than 14,000 cubic yards per year of sediment is estimated to be deposited into channels (confirmed by City of San Diego dredging records).

Legend

- Altamont clay, 15-30%
- Altamont clay, 9-15%
- Carlsbad gravelly loam sand, 2-5%
- Chesterton fine sandy loam, 2-5%
- Chesterton fine sandy loam, 5-9%
- Chesterton-Urban land complex, 2-9%
- Cieneba coarse sandy loam, eroded, 5-15%
- Cieneba rocky coarse sandy loam, 9-30%
- Diablo clay, 15-30%
- Diablo-Olivenhain complex, 9-30%
- Friant rocky fine sandy loam, 30-70%
- Friant rocky fine sandy loam, 9-30%
- Gaviota fine sandy loam, 30-50%
- Gravel Pit
- Loamy alluvial land-Huerhuero complex, severely eroded, 9-50%
- Not listed as perennial or intermittent
- Olivenhain cobbly loam, 2-9%
- Olivenhain cobbly loam, 9-30%
- Ollivenhain cobbly loam, 30-50%
- Redding cobbly loam, 9-30%
- Redding cobbly loam, dissected, 15-30%
- Redding gravelly loam, 2-9%
- Riverwash
- San Miguel-Exchequer rocky silt loams, 9-70%
- Stony land
- Terrace escarpments
- Visalia gravelly sandy loam, 2-5%



Miles

0 0.5 1 2 3

This map is for planning purposes only. Some data may be incomplete, inaccurately positioned, and/or generalized.

MCAS Miramar Soils

Figure 3.2a

Source: SANDAG (USDA soil surveys)

GeomorphIS *2006*

Contours (40 FT)

100-Year Flood Zone

WATERS OF THE UNITED STATES

Non-Wetland Waters

Possible Non-Vernal Pool Wetlands

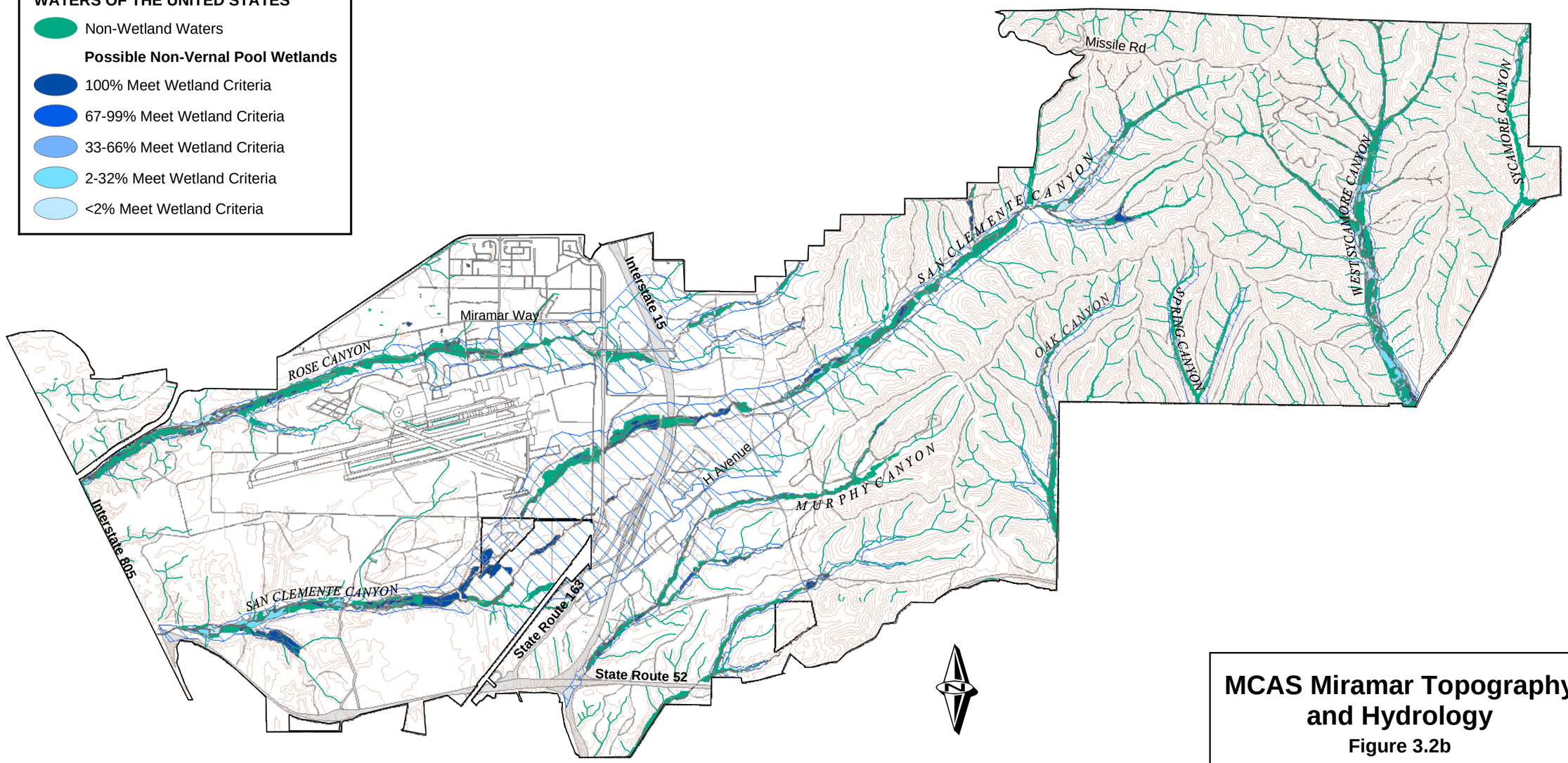
100% Meet Wetland Criteria

67-99% Meet Wetland Criteria

33-66% Meet Wetland Criteria

2-32% Meet Wetland Criteria

<2% Meet Wetland Criteria



MCAS Miramar Topography and Hydrology

Figure 3.2b

Sources: Contour Data - SANDAG/SDSU
Waters of the U.S. - Smith and Lichvar 2001

GeomorphIS *2006*

This map is for planning purposes only. Some data may be incomplete, inaccurately positioned, and/or generalized.

3.3.3 Water Quality

MCAS Miramar water is supplied by a contract with the City of San Diego. The City gets its water from the Colorado River, the State Water Projects California Aqueduct, and other distant sources. In the 1991 erosion survey (Kellogg and Kellogg 1991), 51 active sites and 31 other sites with minor activity were identified. Sediment yield to channels, largely due to erosion, was estimated at over 30,000 tons per year.

In 2004-05 URS (2005) inventoried the Station to assess, document, and prioritize active erosion sites and provide recommendations for restoration of priority erosion sites. URS identified 98 sites with erosion problems; 68 contained gullies. Rills were identified at 19 sites; channel erosion at 8 sites; streambank erosion at 6 sites; slumps at 5 sites; and mass wasting was recorded at 12 sites. The eastern part of the Station has many mass wasting features that are not threatening Station facilities, and were too numerous and inaccessible to record in this survey effort; mass wasting sites that are threatening facilities or were accessible were identified. Section 7.3.1.1, *Soil Erosion and Revegetation* has more detail on the results of this inventory.

Streambank erosion problems along San Clemente and Rose canyons were identified in a sedimentation study commissioned by the City of San Diego (Woodward-Clyde 1986). Streambanks are typically 10-12 feet high but can be as high as 200 feet. Channel sides and bottoms are of cobble alluvium. Loose colluvial sand is common in canyon bottoms (Lloyd-Reilly 1987; Woodward-Clyde 1986).

An earlier study (Tetratech, Inc. 1983) had concluded that Rose Canyon was a source of high concentrations of organically rich fine sediments draining into Mission Bay, aggravating the silting of the bay and degrading bottom sediments. In an aerial photo comparison of stream channel conditions in 1928 (when these lands were used for ranching) and 1991 (Kellogg and Kellogg 1991), most channels were found to be well-defined, flowing with water and full of sediment in 1928. By 1991 these areas were almost completely vegetated with no defined channel, probably due to bed aggradation.

3.4 Potentially Contaminated Sites and Areas Containing Munitions and Explosives of Concern

There are areas of MCAS Miramar that have been identified by various reports as sites where the disposal or discharge of hazardous wastes has resulted in potential environmental contamination. In addition, there are sites where munitions and explosives of concern are potentially and/or confirmed to be present.

The primary concern with munitions and explosives of concern is the risk to public health and welfare associated with the potential presence of unexploded live ordnance (armed with exploding warhead). If disturbed, unexploded live ordnance can be deadly. Although not as dangerous as unexploded live ordnance, inert practice ordnance with unexploded signal cartridges is also hazardous.

The second concern with munitions and explosives of concern is the potential for environmental contamination. Hazardous constituents contained in munitions and explosives of concern are usually consumed in a series of chemical reactions that occur upon detonation. Occasionally, munitions do not fully detonate or do not detonate at all. If these non-detonated munitions are not recovered and the munitions case is damaged or eventually corrodes, hazardous constituents could leach out into the environment.

Sites where hazardous materials disposal or discharge may have resulted in contamination were identified under the Installation Restoration Program, which addresses the identification, investigation, research, and cleanup of contaminated Installation Restoration sites. There are 18 identified Installation Restoration Program sites on MCAS Miramar. Eleven of the sites have been closed because cleanup action is unnecessary

or removal has already been conducted. There are seven active Installation Restoration sites on MCAS Miramar as listed below.

1. Petroleum, oil, and lubricant products and underground storage tank bottom sludges were sprayed or spread on the ground between the early 1940s and 1975 for dust control at several areas within the ***Fuel Farm Operation Area***. Most petroleum, oil, and lubricant wastes were disposed of on and around the fuel farm itself.
2. The ***Rose Canyon Area*** was used for the disposal of wastes, including oils, greases, hydraulic fluid, fuels, solvents, paint thinners, plating wastewater, corrosive wastes, and berryllium dust during the 1940s and 1950s. An estimated 500,000 gallons of these wastes have been discharged to Rose Canyon since the 1940s.
3. From the 1940s until 1972 refuse from the Station was disposed of in the ***San Clemente Canyon Disposal Area***. Hazardous materials disposed of in this area included waste paints, pesticides, solvents, and spent lead acid batteries. Assessment of this site is underway.
4. The former ***Sycamore Canyon Atlas Missile Facility*** was contaminated with polychlorinated biphenyl and asbestos-containing material. The asbestos-containing material abatement was completed in 1997, and assessment of the polychlorinated biphenyl contamination is underway. A portion of this facility is used for an Explosive Ordnance Demolition range (Section 2.3.2, *Firing Ranges*).
5 The ***Supply Drum Storage Area*** is a site that was once used as a hazardous waste storage area.
6. The old ***Boiler Plant*** that previously provided heat and hot water service to the Station had a mercury spill during removal of an underground storage tank and piping.
7. Old leaking underground fuel storage tanks at the ***Main MCX Gas Station*** resulted in soil and groundwater contamination. Assessment to delineate the extent of contamination is underway.

There are 46 separate old firing ranges, impact areas, and areas where ordnance may exist on MCAS Miramar. These areas are throughout the Station and encompass approximately 1/3 of the land area of East Miramar. The location of the ranges and the munitions and explosives of concern that can be expected to be encountered are summarized in *Range Identification and Preliminary Range Assessment, Marine Corps Air Station Miramar* (U.S. Army Corps of Engineers, St. Louis District 2001).

Additional information pertaining to potentially contaminated sites and areas containing munitions and explosives of concern can be obtained by contacting the MCAS Miramar, Environmental Management Department, Engineering Division.